JC05 Rec'd PCT/PTO 14 DEC 2001

FORM PTO-1390 US DEPARTMENT OF COMMERCE REV. 5-93 PATENT AND TRADEMARK OFFICE **TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371**		ATTORNEYS DOCKET NUMBER **P01,0531** U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/018292
INTERNATIONAL APPLICATION NO. **PCT/EP00/04354**	INTERNATIONAL FILING DATE **15 MAY 2000**	PRIORITY DATE CLAIMED **15 JUNE 1999**
TITLE OF INVENTION **METHOD, DEVICE AND ARRANGEMENT FOR MESSAGE TRANSMISSION**		
APPLICANT(S) FOR DO/EO/US **Klaus David GRADISCHNIG, et al.**		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report, 05 References)**.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ Amendment "A" Prior to Action and Appendix "A".
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification and substitute specification mark-up.
15. ☒ A change of address letter attached to the Declaration.
16. ☒ Other items or information:
    a. ☒ Submission of Drawings- 7 sheets of drawings, Figures 1-6.
    b. ☒ EXPRESS MAIL #EL 843743807 US dated December 14, 2001

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U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/018292	PCT/EP00/04354	P01,0531

17. ☒ The following fees are submitted:				CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $890.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) $710.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C F.R. 1.445(a)(2) $740.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $1040.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $ 100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				$ 890.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F R. 1.492(e)).				$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	08 - 20 =	0	X $ 18.00	$	
Independent Claims	03 - 3 =	0	X $ 84.00	$	
Multiple Dependent Claims			$280.00 +	$	
TOTAL OF ABOVE CALCULATIONS =				$ 890.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)				$	
SUBTOTAL =				$ 890.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1 492(f)). +				$	
TOTAL NATIONAL FEE =				$ 890.00	
Fee for recording the enclosed assignment (37 C.F.R 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31) $40.00 per property +					
TOTAL FEES ENCLOSED =				$ 890.00	
				Amount to be refunded	$
				charged	$

a. ☒ A check in the amount of $ 890.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. __________ in the amount of $ _______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1519. **A duplicate copy of this sheet is enclosed.**

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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BOX PCT
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

PRELIMINARY AMENDMENT A
PRIOR TO ACTION

APPLICANT(S):	Klaus David GRADISCHNIG, et al.
ATTORNEY DOCKET NO.:	P01,0531
INTERNATIONAL APPLICATION NO:	PCT/EP00/04354
INTERNATIONAL FILING DATE:	15 May 2000

INVENTION: METHOD, DEVICE AND ARRANGEMENT FOR MESSAGE TRANSMISSION

Assistant Commissioner for Patents,
Washington D.C. 20231

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination on the United States Examination Phase.

IN THE CLAIMS:

On amended page 11:

replace line 1 with --WHAT IS CLAIMED IS:--;

Please replace original claims 1-8 with the following rewritten claims 1-8, referring to the mark-ups in Appendix A.

1. (Amended) A method for transmitting messages between a transmitting device and a receiving device of a transmission link, comprising:

consecutively numbering messages on a transmission;

re-requesting messages by the receiving device if it finds gaps in a received message stream utilizing the consecutive numbering in the transmission; and

delivering to a device of a higher level than the receiving device all messages or only messages having special features immediately after reception by the receiving device, independently of whether messages need to be repeated by the transmitting device due to a gap found by the receiving device.

2. (Amended) The method as claimed in claim 1, further comprising:

delivering immediately delivered messages to a multiplex device by the receiving device; and

allocating, by the multiplex device, received messages to different message streams utilizing special features of the received message and continuing to treat messages of a message stream independently of messages of another stream.

3. (Amended) The method as claimed in claim 1, wherein the special feature is at least one of a marking, added in messages by the transmitting device, and a particular content of the messages.

4. (Amended) The method as claimed in claim 2, wherein the multiplex device is a device of the transmission link itself or a device of a higher protocol layer than the transmission link.

5. (Amended) A device of a transmission link, comprising:

a receiver which receives consecutively numbered messages and requests messages again if it finds gaps in the received message stream with the aid of the consecutive numbering, wherein the receiver immediately after reception delivers all messages or only messages having special features to a device higher than the receiver independently of whether messages need to be repeated by the transmitting device due to a gap found.

6. (Amended) A communications system, comprising:

a transmission link;

a transmitter connected to the transmission link which transmits message streams having consecutively numbered messages;

a multiplex device connected to the transmission link implementing a multiplexing layer; and

a receiver connected to the transmission link that receives the consecutively numbered messages and requests messages again if the receiver finds gaps in the received message stream with the aid of the consecutive numbering of the message and, immediately after the reception, delivers all messages or only messages having special features to the multiplex device independently of whether messages need to be repeated by the transmitting device due to a gap having been found, wherein the multiplex device which allocates received messages to different message streams utilizing special features of the messages and continues to treat messages of a message stream independently of messages of another stream.

7. (Amended) The device according to claim 6, wherein the multiplex device is a device of the transmission link itself or a device of a higher protocol layer than the transmission link.

8. (Amended) A method as claimed in claim 1, wherein the method is carried out in a protocol according to Q.2210 or a protocol derived therefrom, in such a manner that in the sequenced-data protocol data units, a previously unused bit is used for identifying messages which are to be immediately delivered to the receiving device.

REMARKS

The present Amendment revises the specification and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. Pursuant to 37 CFR 1.125 (b), applicants have concurrently submitted a substitute specification, excluding the claims, and provided a marked-up copy. All of the changes are editorial and applicant believes no new matter is added thereby. The amendment, addition, and/or cancellation of claims is not intended to be a surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

Submitted by,

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Appendix A
Mark Ups for Claim Amendments

1. **(Amended)** A method for transmitting messages between a transmitting device and a receiving device of a transmission link, [~~according to which~~]**comprising:**

[~~———— messages are~~]consecutively [~~numbered~~]**numbering messages** on **a** transmission[~~, and~~]**;**

[~~–~~]**re-requesting** messages[~~ are requested again~~] by the receiving device if it finds gaps in [~~the~~]**a** received message stream [~~with the aid of~~]**utilizing** the consecutive numbering[~~,~~] **in the transmission; and**

[~~——— characterized in that~~]

[~~————~~][~~immediately after reception~~][~~,~~]**delivering to a device of a higher level** ~~— service user —~~**than the receiving device** all messages or only messages having special features[~~, are delivered to a higher~~] ~~——— ———~~**immediately after reception**~~,~~ **by the receiving** device[~~— service user —~~][~~than the receiving device~~]**,** independently of whether messages need to be repeated by the transmitting device due to a gap found by the receiving device.

2. **(Amended)** The method as claimed in claim 1, [~~characterized in that messages which are~~]**further comprising:**

delivering immediately delivered [~~are delivered~~]**messages** to a multiplex device by the receiving device[~~, the multiplex device~~]**; and**

allocating**, by the multiplex device,** received messages to different message streams [~~by means of said~~]**utilizing** special features **of the received message** and continuing to treat messages of a message stream independently of messages of another stream.

3. **(Amended)** The method as claimed in claim [~~1 or 2, characterized in that a~~]**1, wherein the** special feature is **at least one of** a marking, added in [~~the~~]messages by the transmitting device, and[~~/or~~] a particular content of the messages.

4. **(Amended)** The method as claimed in [~~one of claims 2 to 3, characterized in that said~~]**claim 2, wherein the** multiplex device is a device of the transmission link itself or a device of a higher protocol layer than the transmission link.

5.[~~—A~~] [~~receiving~~]**(Amended) A** device of a transmission link**, comprising:**

a receiver which receives consecutively numbered messages and requests messages again if it finds gaps in the received message stream with the aid of the consecutive numbering, [~~characterized in that,~~]**wherein the receiver** immediately after reception[~~, it~~] delivers all messages or only messages having special features to a **device** higher [~~device — service user —~~]than the [~~receiving device~~]**receiver** independently of whether messages need to be repeated by the transmitting device due to a gap found.

6. (Amended) A communications system, comprising:

a transmission link;

a transmitter connected to the transmission link which transmits message streams having consecutively numbered messages;

a multiplex device connected to the transmission link implementing a multiplexing layer; and

[~~6. Device of a transmission link, consisting of a receiving device, which~~]**a receiver connected to the transmission link that** receives **the** consecutively numbered messages and requests messages again if [~~it~~]**the receiver** finds gaps in the received message stream with the aid of the consecutive numbering **of the message** and, immediately after the reception, delivers all messages or only messages having special features to [~~a higher level~~]**the** multiplex device independently of whether messages need to be repeated by the transmitting device due to a gap having been found[~~, and of a~~]**, wherein the** multiplex device which allocates received messages to different message streams [~~by means of~~]**utilizing** special features of the messages and continues to treat messages of a message stream independently of messages of another stream.

7. **(Amended)** The device according to claim 6, [~~characterized in that said~~]**wherein the** multiplex device is a device of the transmission link itself or a device of a higher protocol layer than the transmission link.

8. **(Amended)** A method as claimed in [~~one of claims 1 to 4, characterized in that~~]**claim 1, wherein** the method is carried out in a protocol according to Q.2210 or a protocol derived therefrom, in such a manner that in the sequenced-data protocol data units[~~— SD PDUs —~~]**,** a previously unused bit [~~(I)~~]is used for identifying messages which are to be immediately delivered to the [~~receiver~~]**receiving device**.

7/PRTS

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SPECIFICATION

TITLE

METHOD, DEVICE AND ARRANGEMENT FOR MESSAGE TRANSMISSION

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The invention is directed to a method, device and arrangement for transmitting messages between a transmitting device and a receiving device of a transmission link in which messages are consecutively numbered on transmission and messages are re-requested by the receiving device if it finds gaps in the received message stream with the aid of the consecutive numbering.

DESCRIPTION OF THE RELATED ART

[0002] In many applications, a number of mutually independent message streams, i.e., messages for different receivers (or for different, mutually independent activities of a receiver) are transmitted via a transmission link which uses a transmission protocol with error-protected message transmission. The receiver is understood in this context to be a user of the transmission link, e.g., a particular class of a higher protocol layer.

[0003] The error-protected message transmission normally also requires delivery of the messages in the same order in which they have been sent. However, since the transmission protocol is frequently unable to distinguish between the message streams, the delivery of the messages of a message stream may be delayed because one or more preceding messages of one or more other message streams have been lost and must be repeated.

[0004] The problem is not solved directly in the existing ITU-T signaling system No. 7. However, the use of a number of transmission links (up to 16) (which is frequently the case, particularly when the MTP of level 2 is used (according to ITU-T Recommendation Q.703)) between two signaling points results in a certain decoupling of the data streams (due to the signaling link selection fields, 16 data streams are distinguished in the case of ITU and 256 data streams are distinguished in the case of ANSI) as a side effect, since transmission errors on one transmission link do not influence the message flow on other transmission links.

[0005] In the broadband signaling network, however, transmission links are rarely used in greater numbers (normally no more than two are needed) because of the use of high-capacity transmission links. There is, therefore, much less separation between the independent data streams. Nor does the protocol used (SSCOP, Q.2110) offer any possibility of distinguishing between different data streams.

SUMMARY OF THE INVENTION

[0006] The present invention permits a simple expansion of existing protocols using the so-called "multiple selective retransmission" (MSR) method – and, in particular, SSCOP (Q.2110) or protocols derived from them – with functions that solve the problem described above.

[0007] The invention is distinguished from the "go-back-N" method in which, when an error/loss occurs, all data packets are retransmitted from this error/loss onward even if subsequent data packets have already been sent without errors, only the data packets which are actually faulty/lost are retransmitted in the Selective Reject Method. MSR methods allow the existence of a number of gaps in the data stream and can initiate the repetition of a number of or all missing data with a single request.

[0008] The invention is based in part on the fact that SSCOP can be expanded in a very simple manner to also deliver messages "out of sequence". Thus, a further protocol level can then provide its users (applications, i.e., higher protocol levels) in a simple manner with streams which cannot block one another.

[0009] When implicit features are used, i.e., information already contained in data and/or protocol information of the higher protocol levels such as the SLS field according to Q.704 or Q.2210 for identifying the streams, these can be introduced transparently as non-jamming streams for higher protocol levels, i.e., without the higher-level protocols having to adapt to or know about the introduction of the streams.

[0010] In the exemplary embodiment SSCOP/SSCF considered here, which is based on the protocol stack shown in Figure 2, it is advantageous to split the problem of error-protected in-sequence message transmission in mutually independent streams into two part-problems and to solve a first part-problem in the SSCOP and a second one in the SSCF. However, this splitting is not mandatory and

not necessarily advantageous even if the protocol to be modified does not already have a layer structure.

DESCRIPTION OF THE DRAWINGS

[0011] The attached drawings with Figures 1 to 6 supports the representation of the invention described above.

Figure 1 is a data structure diagram showing Sequenced Data PDU with identification of "in-sequence delivery";

Figure 2 is a block diagram showing the protocol layer model for the NNI signaling in the broadband ISDN;

Figure 3 is a data structure diagram showing the message format of the modified SSCF;

Figures 4 and 5 are flowcharts describing additional SSCF functions when sending SSCF PDUs/MTP 3b data with an existing SSCOP connection (states 3/10/5, 2/10/3, 2/10/4) as SSCOP SD PDUs; and

Figure 6 is a flowchart illustrating modifications to the SSCOP process of Figure 5, in Q.2110.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The text which follows describes a two-stage solution and the advantages of this structuring in the case of SSCOP/SSCF.

[0013] In a first stage, SSCOP – or another protocol using the "multiple selective retransmission" method – is expanded in such a manner that it is capable of delivering messages immediately to the receiver of the message even when older messages have not yet been correctly received and delivered. In this arrangement, all or only special messages can be delivered to the receiver immediately on reception, the expression "immediately" meaning that the delivery of these messages is not delayed by detection of the loss of other messages.

[0014] In the receive buffer used for establishing the correct order of reception, which is needed in the case of protocols with the "multiple selective retransmission" method by the receiving device of the protocol, those messages intended for immediate delivery are thus no longer necessarily temporarily stored until all

preceding messages have been received; rather, advantageously, only a note is made (e.g., by storing and correspondingly marking the sequence number, but not the data, of the received and delivered message in the receive buffer) that these messages have been correctly received and delivered to the receiver. Thus, as already mentioned, the delivery of these messages is not delayed by the loss of other messages. It is of no significance for the present invention whether or not the data of these messages intended for immediate delivery are temporarily stored until all preceding messages are present, even though the latter can be advantageous. The essential factor is only the noting that these messages have already been delivered and, therefore, do not need to be delivered again to the users.

[0015] Another advantage is that less memory needs to be reserved for receive buffers since the data of such messages does not need to be temporarily stored but, e.g., only their sequence numbers with corresponding marking.

[0016] If only special (particular) messages are to make use of this function, a certain marking (identification) can be made for such messages in the messages (this identification is not to be mistaken for the marking of the sequence numbers stored in the receive buffer for the messages already delivered, previously described by way of an example), or such messages can be recognized from their content. An example of the latter are messages which belong to SCCP Class 0 (see Q.714) and which are identified by the value 0 in the protocol class parameter field of the SCCP message, and in the case of which an (essentially) reliable delivery but not a delivery in the correct order is needed by the applications (users of the SCCP).

[0017] It is also advantageous that, in principle, the immediate delivery to the receiver can take place without knowledge or modification of the transmitting device. Alternately, the transmitting device can identify messages for immediate delivery, in principle, without the receiving device of the protocol necessarily having to take note of this identification, i.e., the receiving device still delivers all messages complete and in the correct order to the next higher protocol level. Although the advantage of immediate delivery of at least certain messages is thus no longer provided, the protocol still operates correctly, i.e., the higher protocol levels receive all messages in the correct order. If then a protocol field not yet used (i.e., reserved) is then used for identification, this function can thus be introduced downward compatibly, i.e., a transmitting device using this identification can correctly communicate with a

receiving device even when the latter ignores this identification because, for example, it doesn't understand it.

[0018] However, it must be noted whether the users of the protocol thus modified are assuming that all messages are delivered in strict sequence (such as the protocols for retrieval described in Q.2210 and Q.2140, when Q.2110 is used). It is then necessary to determine whether the present invention should not be applied or the functions of the user protocols which are based on a delivery in strict sequence are modified or restricted. For example, in the case of Q.2110 and Q.2140, Q.2140 would have to be modified to the extent that, following an AAL RETRIEVE BSNT request by Q.2210, the modified Q.2140 returns an AAL BSNT confirm to Q.2210, in which the value of the BSNT parameter contained therein is equal to the maximum value of the SN value received in AA DATA indication. As a consequence, messages having a lower sequence number than the SN value which has not yet been received or which may not yet have been delivered to the user by SSCF are then lost.

[0019] In a second stage, functions are introduced that make it possible to control a multiplicity of different message streams in such a manner that messages of one stream are delivered in the correct order but message losses on other streams do not delay the delivery of messages of the one stream. Advantageously, these functions are introduced not as part of the SSCOP or other existing protocols expanded in accordance with the first stage, but in a separate protocol layer which can be called a convergence or multiplexing layer, although a direct introduction into the existing protocols already modified is also possible.

[0020] Depending on the application, an existing convergence layer can be expanded for this purpose (e.g., the SSCF for the NNI, described in Q.2140) or a new convergence layer can be introduced. With respect to the data transmitted via the transmission link, two identification codes are necessary for this. One is an identification of the data stream and the other one a consecutive numbering of the messages within a data stream. If necessary, control messages for controlling (e.g., initializing) the individual data streams must also be defined.

[0021] In the identification of the message stream, an advantage of the arrangement of the function is found in a separate protocol layer. As a result, it may

be possible to use message stream identifications already contained in the data of the users which renders unnecessary the introduction of a separate protocol field for this purpose and thus saves transmission capacity. Also as a result, it is not necessary to change the interface between the transmission protocol and its (existing) user.

[0022] For example, this is possible in MTP Level 3 (Q.2210, Q.704) which – depending on ITU-T or ANSI as dict. – identifies between 16 and 256 explicit protocol streams via the so-called signaling link selection field (SLS). Furthermore, if necessary, additional preexisting information from the messages (e.g., origin and/or destination addresses or their parts) can be used in this special case in order to achieve a finer subdivision of the messages into individual, mutually independent streams. The layer Q.2140 between Q.2210 (broadband MTP Level 3) and Q.2110 (SSCOP) could thus be correspondingly modified without this having any influence on Q.2210.

[0023] As an alternative, the message streams can also be explicitly identified by a new protocol field which has the advantage that this can be done independently of the application, i.e., the convergence or multiplexing layer no longer needs to be informed about the fields of the user protocols. However, the interface to existing users must then be expanded since, at least on handover and possibly on receipt of data, the stream to which the data belong must be explicitly identified. Furthermore, additional data must normally be transmitted because existing protocols rarely have sufficiently large unused fields although this is not impossible.

[0024] For the consecutive numbering of the messages within a data stream, too, a new field will normally have to be introduced in the messages because existing protocols rarely (but possibly) have sufficiently large unused fields.

[0025] Control messages or fields for controlling the message streams are needed, in particular, when number and existence of the streams are not fixed but must be dynamically agreed upon between the two end points of the transmission link. If, however, permanently defined message streams are used as a basis, special control of the message streams is not absolutely necessary. However, special control may be advantageous since, as a result, the protocol can be made more rugged and protocol errors which may have occurred in a message stream can have

no influence on other streams. If no special control is carried out, the streams are automatically initialized on connection set-up of the basic protocol (e.g. SSCOP).

[0026] The following possible control functions can be considered, for example:

- opening and ending a stream;
- resetting the sequence numbers of a stream; and
- stream-related flow control.

[0027] Functionally, the convergence layer (or the function additionally built into the protocol) has to fulfill the following tasks:

- administering a receive buffer for each (active) stream.administering a transmit and a receive sequence number;
- receiving the messages for a stream and checking the sequence number;
- if there are no gaps in the sequence number, delivery of the message - and possibly other messages waiting for this message in the receive buffer – to the user;
- if there are gaps in the sequence number, temporarily storing the message in the receive buffer;
- on transmission of the message, allocation of the transmit sequence number and possibly of the stream identification; and
- if necessary, performing the control functions.

[0028] Furthermore, it may be advantageous that delivery in the correct order is dispensed with for one (or more) of the streams (which is used, for example, for messages of SCCP Class 0).

[0029] In an exemplary embodiment shown in Figure 1, SSCOP (Q.2110) is modified to the extent that a free bit is used in SD-PDUs for identifying messages which do not need to be delivered in sequence. Figure 1 shows and embodiment where the AA DATA signals are equipped with an additional parameter I at the interface to the SSCOP user. I = SD indicates that sequenced delivery has been

requested (with AA Data. indication) or is requested (with AA Data. request), i.e. field I in the SD.PDU is or has been set to 0. I = USD indicates that sequenced delivery has not been or is not requested.

[0030] Furthermore, Q.2140 can be modified to the extent that 17 streams are introduced, one for SCCP Class 0 messages and 16 for the 16 possible SLS values of other messages (see Figures 4, 5 and 6). To avoid any change in the users, the maximum allowable message length for the SSCOP (parameter k) is simultaneously increased to 4100 octets, since the modified SSCF needs an additional 4 octets of space (for fields SQ#,St# and status) per message (SD PDU with MTP 3b data) (see Figure 3). According to Figure 3, SQ# = Stream sequence number; St# = Stream number; and Status (St#=0) or control field (St#≠0). The functions of the status field are described in Q.2140. As a control field (only with stream number ≠ 0), the field has the following meaning: Bit 1= In-sequence delivery bit (0 = in-sequence delivery required and 1 = in-sequence delivery not required; Bits 2 to 8 are reserved)

[0031] In Figures 4 and 5, is a flowchart describing additional SSCF functions when sending SSCF PDUs/MTP 3b data with an existing SSCOP connection (states 3/10/5, 2/10/3, 2/10/4) as SSCOP SD PDUs, showing new transmitter variables VT(S.n), where 1<=n<=16 transmit sequence counter per stream, that are initialized with zero on SSCOP connection setup or reset.

[0032] The present invention is not restricted to MSR methods. It can also be applied to normal selective reject methods and also to go-back-N methods. In these cases, however, more adaptations, e.g., an introduction of a receive buffer or a status bar for tracking the messages already delivered, are required in the receiving device than in the MSR methods. The above-described method and apparatus are illustrative of the principles of the present invention. Numerous modifications and adaptations will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.

ABSTRACT

Frequently, a number of mutually independent message streams (e.g., messages for different receivers) are transmitted via a transmission link which exhibits a transmission protocol with error protected message transmission. However, since the transmission protocol is frequently unable to distinguish between the message streams, it may happen that the delivery of the messages of a message stream is delayed because a preceding message of another message stream has been lost and must be repeated. This problem is solved by the invention.

SPECIFICATION

TITLE

METHOD, DEVICE AND ARRANGEMENT FOR MESSAGE TRANSMISSION

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The invention is directed to a method~~Method~~**, device and arrangement for** ~~Method for improving message transmission~~**transmitting messages between a transmitting device and a receiving device of a transmission link in which messages are consecutively numbered on transmission and messages are re-requested by the receiving device if it finds gaps in the received message stream with the aid of the consecutive numbering.**

DESCRIPTION

[~~Method~~] [~~, device and arrangement for~~] [~~improving message transmission~~]
[~~1. What is the technical problem which is to be solved by your invention?~~]
[~~2. How has this problem been previously solved?~~]
[~~3. How does your invention solve the technical problem specified (state its advantages)?~~] [~~4. Exemplary embodiment(s)~~] OF THE [~~invention.~~] **RELATED ART**
[~~5. Drawing~~]
[~~re 1.~~]

[0002]]In many applications, a number of mutually independent message streams, i.e., messages for different receivers (or for different, mutually independent activities of a receiver [~~,~~]) are transmitted via a transmission link which [~~exhibits~~] **uses** a transmission protocol with error-protected message transmission [~~,~~] **. The** receiver [~~being~~] **is** understood **in this context** to be a user of the transmission link, e.g., a particular class of a higher protocol layer.

[0003] [~~Since the~~] **The** error-protected message transmission normally also requires delivery of the messages in the same order in which they have been sent**. However,** [~~but~~] **since** the transmission protocol is frequently unable to distinguish between the message streams, [~~it may happen that~~] the delivery of the messages of a message stream [~~is~~] **may be** delayed because one or more

preceding messages of one or more other message streams have been lost and must be repeated.

[~~Re 2.~~]

[0004]]The problem is not solved directly in the existing ITU-T signaling system No. 7. However, the use of a number of transmission links (up to 16) (which is frequently the case, particularly when the MTP of level 2 is used (according to ITU-T Recommendation Q.703)) between two signaling points results in a certain decoupling of the data streams (due to the signaling link selection fields, 16 data streams are distinguished in the case of ITU and 256 data streams are distinguished in the case of ANSI) as a side effect, since transmission errors on one transmission link do not influence the message flow on other transmission links.

[0005] In the broadband signaling network, however, [~~it is rarely the case that~~] transmission links are **rarely** used in greater numbers (normally no more than two are needed) because of the use of high-capacity transmission links. There is, therefore, much less separation between the independent data streams. Nor does the protocol used (SSCOP, Q.2110) offer any possibility of distinguishing between different data streams.

[~~Re 3.~~]

SUMMARY OF THE INVENTION

[0006] The present invention [~~shows how~~] **permits a simple expansion of** existing protocols using the so-called "multiple selective retransmission" (MSR) method – and, in particular, SSCOP (Q.2110) or protocols derived [~~therefrom~~] **from them** – [~~can be expanded in a simple manner –~~] with functions [~~which~~] **that** solve the problem described [~~at 1. (insert: in contrast to the so-called go-back-N~~] [~~-method in which, when an error/loss occurs, all data packets are retransmitted from this error/loss onward even if subsequent data packets~~] **above.**

[0007] The invention is distinguished from the "go-back-N"~~at 1. (insert: in contrast to the so-called go-back-N~~ **method in which, when an error/loss occurs, all data packets are retransmitted from this error/loss onward even if subsequent data packets** have already been sent

without errors, only the data packets which are actually faulty/lost are retransmitted in the Selective Reject Method. MSR methods allow the existence of a number of gaps in the data stream and can initiate the repetition of a number of or all missing data with a single request [~~)~~].

[0008] The invention is based **in part** on the [~~following findings, among others.~~] **fact that** SSCOP can be expanded in a very simple manner to also deliver messages "out of sequence". Thus, a further protocol level can then provide its users (applications [~~)~~], i.e.**,** higher protocol levels**)** in a simple manner with streams which cannot block one another.

[0009] When implicit features are used, i.e.**,** information already contained in data and/or protocol information of the higher protocol levels such as [~~, e.g.~~] the SLS field according to Q.704 or Q.2210 for identifying the streams, these can be introduced transparently as non-jamming streams for higher protocol levels, i.e.**,** without the higher-level protocols having to adapt to or know about the introduction of the streams.

[0010] In the exemplary embodiment SSCOP/SSCF considered here, which is based on the protocol stack **shown** in Figure 2, it is advantageous to split the problem of error-protected in-sequence message transmission in mutually independent streams into two part-problems and to solve [~~one~~] **a first** part-problem in the SSCOP and [~~the~~] **a** [~~other~~] **second** one in the SSCF. However, this splitting is not mandatory and not necessarily advantageous even if the protocol to be modified does not already have a layer structure.

DESCRIPTION OF THE DRAWINGS

[0011] The attached drawings~~The attached drawing~~ **with Figures 1 to 6 supports the representation of the invention described**~~above.~~ **above.**

Figure 1 is a data structure diagram showing Sequenced Data PDU with identification of "in-sequence delivery";

Figure 2 is a block diagram showing the protocol layer model for the NNI signaling in the broadband ISDN;

Figure 3 is a data structure diagram showing the message format of the modified SSCF;

Figures 4 and 5 are flowcharts describing additional SSCF functions when sending SSCF PDUs/MTP 3b data with an existing SSCOP connection (states 3/10/5, 2/10/3, 2/10/4) as SSCOP SD PDUs; and

Figure 6 is a flowchart illustrating modifications to the SSCOP process of Figure 5, in Q.2110.

DETAILED DESCRIPTION OF THE INVENTION

[0012] [~~In the~~] **The** text which follows [~~,~~] **describes** a two-stage solution [~~is described~~] and the advantages of this structuring in the case of SSCOP/SSCF [~~are specified~~].

[0013] **In a first stage, SSCOP – or another protocol using the** ~~so-called~~ **"multiple selective retransmission" method – is expanded in such a manner that it** ~~attains the capability~~**is capable of delivering messages immediately to the receiver of the message even when older messages have not yet been correctly received and delivered. In this arrangement, all or only special messages can be delivered to the receiver immediately on reception, the expression "immediately"** ~~being understood to mean~~**meaning that the delivery of these messages is not delayed by detection of the loss of other messages.**

[0014] [~~In a first stage, SSCOP – or another protocol using the~~] [~~so-called~~] [~~"multiple selective retransmission" method – is expanded in such a manner that it~~] [~~attains the capability~~] [~~of delivering messages immediately to the receiver of the message even when older messages have not yet been correctly received and delivered. In this arrangement, all or only special messages can be delivered to the receiver immediately on reception, the expression "immediately"~~] [~~being understood to mean~~] [~~that the delivery of these messages is not delayed by detection of the loss of other messages.~~] In the receive buffer used for establishing the correct order of reception, which is needed in the case of protocols with the "multiple selective retransmission" method by the receiving device of the protocol, those messages intended for immediate delivery are thus no longer necessarily temporarily stored until all preceding messages have

been received**;** [~~but~~] **rather,** advantageously**,** only a note is made (e.g.**,** by storing and correspondingly marking the sequence number**,** but not the data**,** of the received and delivered message in the receive buffer) that these messages have been correctly received and delivered to the receiver. Thus, as already mentioned, the delivery of these messages is not delayed by the loss of other messages [~~—(it~~] **. It** is of no significance for the present invention whether or not the data of these messages intended for immediate delivery are temporarily stored until all preceding messages are present, even though the latter can be advantageous. The essential factor is only the [~~note~~] **noting** that these messages have already been delivered and, therefore, do not need to be delivered again to the users [~~)~~].

[0015] Another advantage is that less memory needs to be reserved for receive buffers since [~~it is no longer~~] the data of such messages [~~which~~] **does not** need to be temporarily stored **but, e.g., only their sequence numbers with corresponding marking.**

[~~but, e.g., only their sequence numbers with corresponding marking.~~]

[0016]]If only special (particular) messages are to make use of this function, a certain marking (identification) can be made for such messages in the messages (this identification **is** not to be mistaken for the marking of the sequence numbers stored in the receive buffer for the messages already delivered, previously [~~quoted~~] **described** by way of an example), or such messages can be recognized from their content. An example of the latter are messages which belong to SCCP Class 0 (see Q.714) and which are identified by the value 0 in the protocol class parameter field of the SCCP message, and in the case of which an (essentially) reliable delivery but not a delivery in the correct order is needed by the applications (users of the SCCP).

[0017] It is also advantageous that, in principle, the immediate delivery to the receiver can take place without knowledge or modification of the transmitting device. [~~On the other hand~~] **Alternately**, the transmitting device can identify messages for immediate delivery, in principle, without the receiving device of the protocol necessarily having to take note of this identification, i.e.**,** the receiving device still delivers all messages complete and in the correct order to the next higher protocol

level. Although the advantage of immediate delivery of at least certain messages is thus no longer [~~given~~] **provided**, the protocol still operates correctly, i.e., the higher protocol levels receive all messages in the correct order. If then a protocol field not yet used (i.e., reserved) is then used for identification, this function can thus be introduced downward compatibly, i.e., a transmitting device using this identification can correctly communicate with a receiving device even when the latter ignores this identification because, for example, it doesn't understand it. [~~However, it must be noted~~]

[0018] **However, it must be noted** whether the users of the protocol thus modified are assuming that all messages are delivered in strict sequence (such as [~~, e.g.,~~] the protocols for retrieval described in Q.2210 and Q.2140, when Q.2110 is used). It is then necessary to [~~weigh up~~] **determine** whether the present invention should not be applied or the functions of the user protocols which are based on a delivery in strict sequence are modified or restricted [~~(~~] **. For example,** in the case of Q.2110 and Q.2140, Q.2140 would have to be modified to the extent that, following an AAL RETRIEVE BSNT request by Q.2210, the modified Q.2140 returns an AAL BSNT confirm to Q.2210, in which the value of the BSNT parameter contained therein is equal to the maximum value of the SN value received in AA DATA indication. As a consequence, messages having a lower sequence number than [~~said~~] **the** SN value which has not yet been received or which may not yet have been delivered to the user by SSCF [~~,~~] are then lost [~~)~~] .

[0019] In a second stage, functions are introduced [~~by means of which~~] **that make** it [~~becomes~~] possible to control a multiplicity of different message streams in such a manner that messages of one stream are delivered in the correct order but message losses on other streams do not delay the delivery of messages of **the** one stream. Advantageously, these functions are introduced not as part of the SSCOP or other existing protocols expanded in accordance with the first stage, but in a separate protocol layer which can be called a convergence or multiplexing layer, although a direct introduction into the existing protocols already modified is also possible. [~~Depending on~~] [~~application, an existing convergence layer can be expanded for this purpose (e.g.~~] [~~the SSCF for the NNI, described in Q.2140) or a new convergence layer can~~]

~~be introduced.~~] [~~With respect to the data transmitted via the transmission link, two~~]

[0020] **Depending on the** ~~Depending on~~ **application, an existing convergence layer can be expanded for this purpose (e.g., the SSCF for the NNI, described in Q.2140) or a new convergence layer can be introduced. With respect to the data transmitted via the transmission link, two** identification codes are necessary for this. One is an identification of the data stream and the other one a consecutive numbering of the messages within a data stream. If necessary, control messages for controlling (e.g., initializing) the individual data streams must also be defined.

[0021] **In the identification of the message stream, an advantage of the arrangement of the function is found in a separate protocol layer. As a result, it may be possible to use message stream identifications already contained in the data of the users which renders unnecessary the introduction of a separate protocol field for this purpose and thus saves transmission capacity. Also as a result, it is not necessary to change the interface between the transmission protocol and its (existing) user.**

[0022] [~~In the identification of the message stream, an advantage of the arrangement of the function is found in a separate protocol layer. As a result, it may be possible to use message stream identifications already contained in the data of the users which renders unnecessary the introduction of a separate protocol field for this purpose and thus saves transmission capacity.~~] [~~Also as a result, it is not necessary to change the interface between the transmission protocol and its (existing) user.~~] For example, this is possible in MTP Level 3 (Q.2210, Q.704) which – depending on ITU-T or ANSI as dict. – identifies between 16 and 256 explicit protocol streams via the so-called signaling link selection field (SLS). Furthermore, if necessary, additional preexisting information from the messages (e.g., origin and/or destination addresses or **their** parts [~~thereof~~]) can be used in this special case in order to achieve a finer subdivision of the messages into individual, mutually independent streams. The layer Q.2140 between Q.2210

(broadband MTP Level 3) and Q.2110 (SSCOP) could thus be correspondingly modified without this having any influence on Q.2210.

[0023] As an alternative, the message streams can also be explicitly identified by a new protocol field which has the advantage that this can be done independently of the application, [~~that is to say~~] **i.e.,** the convergence or multiplexing layer no longer needs to be informed about the fields of the user protocols. However, the interface to existing users must then be expanded since, at least on handover and possibly on receipt of data, the stream to which the data belong must be explicitly identified. [~~In addition~~] **Furthermore**, additional data must normally be transmitted because existing protocols rarely have sufficiently large unused fields although this is not impossible.

[0024] For the consecutive numbering of the messages within a data stream, too, a new field will normally have to be introduced in the messages because existing protocols rarely **(but possibly)** have sufficiently large unused fields [~~, although this is not impossible~~].

[0025] Control messages or fields for controlling the message streams are needed, in particular, when number and existence of the streams are not fixed but must be dynamically agreed **upon** between the two end points of the transmission link. If, however, permanently defined message streams are used as a basis, special control of the message streams is not absolutely necessary. However, [~~it~~] **special control** may be [~~of advantage~~] **advantageous** since, as a result, the protocol can be made more rugged and protocol errors which may have occurred in a message stream can have no influence on other streams. If no special control is carried out, the streams are automatically initialized on connection set-up of the basic protocol (e.g. SSCOP).

[0026] The following possible control functions can be considered, for example:

- opening and ending a stream**;**
- resetting the sequence numbers of a stream**; and**
- stream-related flow control**.**

[0027] Functionally, the convergence layer (or the function additionally built into the protocol) has to fulfill the following tasks:

- administering a receive buffer for each (active) stream.administering a transmit and a receive sequence number [~~.~~] **;**
- [~~Receiving~~] **receiving** the messages for a stream and checking the sequence number [~~.~~] **;**
- [~~If~~] **if** there are no gaps in the sequence number, delivery of the message - and possibly other messages waiting for this message in the receive buffer – to the user [~~.~~] **;**
- [~~If~~] **if** there are gaps in the sequence number, temporarily storing the message in the receive buffer [~~.~~] **;**
- [~~On~~] **on** transmission of the message, allocation of the transmit sequence number and possibly of the stream identification [~~.~~] **; and**
- [~~If~~] **if** necessary, performing the control functions.

[0028] Furthermore, it may be [~~of advantage~~] **advantageous** that delivery in the correct order is dispensed with for one (or more) of the streams (which is used, for example, for messages of SCCP Class 0).

[0029] [~~It should also be noted that the~~] [~~present invention is not restricted to MSR methods. It can also be applied to normal selective reject methods and also to go back N methods. In these cases, however, more adaptations, e.g.~~] [~~introduction of a receive buffer or a status bar for tracking the messages already delivered, are required in the receiving device than in the MSR methods.~~]

[~~Re 4.~~]

[0030]]In an exemplary embodiment [~~,~~] **shown in Figure 1,** SSCOP (Q.2110) is modified to the extent that a free bit is used in SD-PDUs for identifying messages which do not need to be delivered in sequence [~~(see~~] **.** Figure 1 [~~)~~] **shows and embodiment where the AA DATA signals are equipped with an additional parameter I at the interface to the SSCOP user**. [~~Furthermore, Q.2140~~

~~is~~] [~~-modified to the extent that 17 streams are introduced, one for SCCP Class 0 messages and 16 for the 16 possible SLS values of other messages (see Figures 4, 5 and 6). To avoid any change in the users,~~] **I = SD indicates that sequenced delivery has been requested (with AA Data. indication) or is requested (with AA Data. request), i.e. field I in the SD.PDU is or has been set to 0. I = USD indicates that sequenced delivery has not been or is not requested.**

[0031] **Furthermore, Q.2140 can be** ~~Furthermore, Q.2140 is~~ **modified to the extent that 17 streams are introduced, one for SCCP Class 0 messages and 16 for the 16 possible SLS values of other messages (see Figures 4, 5 and 6). To avoid any change in the users,** the maximum allowable message length for the SSCOP (parameter k) is simultaneously increased to 4100 octets, since the modified SSCF needs an additional 4 octets of space (for fields SQ#,St# and status) per message (SD PDU with MTP 3b data) (see Figure 3). **According to Figure 3, SQ# = Stream sequence number; St# = Stream number; and Status (St#=0) or control field (St#≠0). The functions of the status field are described in Q.2140. As a control field (only with stream number ≠ 0), the field has the following meaning: Bit 1= In-sequence delivery bit (0 = in-sequence delivery required and 1 = in-sequence delivery not required; Bits 2 to 8 are reserved)**

[~~Re 5.~~]

[~~The attached drawing~~] [~~-with Figures 1 to 6 supports the representation of the invention described~~] [~~-above.~~]

[0032] In Figures 4 and 5, is a flowchart describing additional SSCF functions when sending SSCF PDUs/MTP 3b data with an existing SSCOP connection (states 3/10/5, 2/10/3, 2/10/4) as SSCOP SD PDUs, showing new transmitter variables VT(S.n), where 1<=n<=16 transmit sequence counter per stream, that are initialized with zero on SSCOP connection setup or reset.

[0033] The~~It should also be noted that the~~ **present invention is not restricted to MSR methods. It can also be applied to normal selective reject methods and also to go-back-N methods. In these cases, however, more adaptations, e.g., an introduction of a receive buffer or a status bar for**

tracking the messages already delivered, are required in the receiving device than in the MSR methods. The above-described method and apparatus are illustrative of the principles of the present invention. Numerous modifications and adaptations will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.

[~~Abstract~~]

[~~Method for~~] [~~transmitting messages between a transmitting device and a receiving device of a transmission link~~] **ABSTRACT**

Frequently, a number of mutually independent message streams (e.g., messages for different receivers) are transmitted via a transmission link which exhibits a transmission protocol with error protected message transmission. However, since the transmission protocol is frequently unable to distinguish between the message streams, it may happen that the delivery of the messages of a message stream is delayed because a preceding message of another message stream has been lost and must be repeated. This problem is solved by the invention.

7/PRTS

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Description

Method, device and arrangement for improving message transmission

1. What is the technical problem which is to be solved by your invention?
2. How has this problem been previously solved?
3. How does your invention solve the technical problem specified (state its advantages)?
4. Exemplary embodiment(s) of the invention.
5. Drawing

re 1.

In many applications, a number of mutually independent message streams, i.e. messages for different receivers or for different, mutually independent activities of a receiver, are transmitted via a transmission link which exhibits a transmission protocol with error-protected message transmission, receiver being understood to be a user of the transmission link, e.g. a particular class of a higher protocol layer.

Since the error-protected message transmission normally also requires delivery of the messages in the same order in which they have been sent but the transmission protocol is frequently unable to distinguish between the message streams, it may happen that the delivery of the messages of a message stream is delayed because one or more preceding messages of one or more other message streams have been lost and must be repeated.

Re 2.

The problem is not solved directly in the existing ITU-T signaling system No. 7. However, the use of a number of transmission links (up to 16) (which is frequently the case particularly when the MTP of level 2 is used (according to ITU-T Recommendation Q.703)) between two signaling points results in a certain decoupling of the data streams (due to the signaling link selection fields, 16 data streams are distinguished in the case of ITU and 256 data streams are distinguished in the case of ANSI) as a side effect since transmission errors on one transmission link do not influence the message flow on other transmission links.

In the broadband signaling network, however, it is rarely the case that transmission links are used in greater numbers (normally no more than two are needed) because of the use of high-capacity transmission links. There is, therefore, much less separation between the independent data streams. Nor does the protocol used (SSCOP, Q.2110) offer any possibility of distinguishing between different data streams.

Re 3.

The present invention shows how existing protocols using the so-called "multiple selective retransmission" (MSR) method - and, in particular, SSCOP (Q.2110) or protocols derived therefrom - can be expanded in a simple manner with functions which solve the problem described at 1. (insert: in contrast to the so-called go-back-N method in which, when an error/loss occurs, all data packets are retransmitted from this error/loss onward even if subsequent data packets

have already been sent without errors, only the data packets which are actually faulty/lost are retransmitted in the Selective Reject Method. MSR methods allow the existence of a number of gaps in the data stream and can initiate the repetition of a number of or all missing data with a single request).

The invention is based on the following findings, among others: SSCOP can be expanded in a very simple manner to also deliver messages "out of sequence". Thus, a further protocol level can then provide its users (applications), i.e. higher protocol levels in a simple manner with streams which cannot block one another.

When implicit features are used, i.e. information already contained in data and/or protocol information of the higher protocol levels such as, e.g. the SLS field according to Q.704 or Q.2210 for identifying the streams, these can be introduced transparently as non-jamming streams for higher protocol levels, i.e. without the higher-level protocols having to adapt to or know about the introduction of the streams.

In the exemplary embodiment SSCOP/SSCF considered here, which is based on the protocol stack in Figure 2, it is advantageous to split the problem of error-protected in-sequence message transmission in mutually independent streams into two part-problems and to solve one part-problem in the SSCOP and the other one in the SSCF. However, this splitting is not mandatory and not necessarily advantageous even if the protocol to be modified does not already have a layer structure.

In the text which follows, a two-stage solution is described and the advantages of this structuring in the case of SSCOP/SSCF are specified.

In a first stage, SSCOP - or another protocol using the so-called "multiple selective retransmission" method - is expanded in such a manner that it attains the capability of delivering messages immediately to the receiver of the message even when older messages have not yet been correctly received and delivered. In this arrangement, all or only special messages can be delivered to the receiver immediately on reception, the expression "immediately" being understood to mean that the delivery of these messages is not delayed by detection of the loss of other messages. In the receive buffer used for establishing the correct order of reception, which is needed in the case of protocols with the "multiple selective retransmission" method by the receiving device of the protocol, those messages intended for immediate delivery are thus no longer necessarily temporarily stored until all preceding messages have been received but advantageously only a note is made (e.g. by storing and correspondingly marking the sequence number but not the data of the received and delivered message in the receive buffer) that these messages have been correctly received and delivered to the receiver. Thus, as already mentioned, the delivery of these messages is not delayed by the loss of other messages (it is of no significance for the present invention whether or not the data of these messages intended for immediate delivery are temporarily stored until all preceding messages are present, even though the latter can be advantageous. The essential factor is only the note that these messages have already been delivered and, therefore, do not need to be delivered again to the users).

Another advantage is that less memory needs to be reserved for receive buffers since it is no longer the data of such messages which need to be temporarily stored

but, e.g., only their sequence numbers with corresponding marking.

If only special (particular) messages are to make use of this function, a certain marking (identification) can be made for such messages in the messages (this identification not to be mistaken for the marking of the sequence numbers stored in the receive buffer for the messages already delivered, previously quoted by way of an example), or such messages can be recognized from their content. An example of the latter are messages which belong to SCCP Class 0 (see Q.714) and which are identified by the value 0 in the protocol class parameter field of the SCCP message, and in the case of which an (essentially) reliable delivery but not a delivery in the correct order is needed by the applications (users of the SCCP).

It is also advantageous that, in principle, the immediate delivery to the receiver can take place without knowledge or modification of the transmitting device. On the other hand, the transmitting device can identify messages for immediate delivery, in principle, without the receiving device of the protocol necessarily having to take note of this identification, i.e. the receiving device still delivers all messages complete and in the correct order to the next higher protocol level. Although the advantage of immediate delivery of at least certain messages is thus no longer given, the protocol still operates correctly, i.e. the higher protocol levels receive all messages in the correct order. If then a protocol field not yet used (i.e. reserved) is then used for identification, this function can thus be introduced downward compatibly, i.e. a transmitting device using this identification can correctly communicate with a receiving device even when the latter ignores this identification because,

for example, it doesn't understand it. However, it must be noted

whether the users of the protocol thus modified are assuming that all messages are delivered in strict sequence (such as, e.g., the protocols for retrieval described in Q.2210 and Q.2140, when Q.2110 is used). It is then necessary to weigh up whether the present invention should not be applied or the functions of the user protocols which are based on a delivery in strict sequence are modified or restricted (in the case of Q.2110 and Q.2140, Q.2140 would have to be modified to the extent that, following an AAL RETRIEVE_BSNT request by Q.2210, the modified Q.2140 returns an AAL BSNT confirm to Q.2210, in which the value of the BSNT parameter contained therein is equal to the maximum value of the SN value received in AA DATA indication. As a consequence, messages having a lower sequence number than said SN value which has not yet been received or which may not yet have been delivered to the user by SSCF, are then lost).

In a second stage, functions are introduced by means of which it becomes possible to control a multiplicity of different message streams in such a manner that messages of one stream are delivered in the correct order but message losses on other streams do not delay the delivery of messages of one stream. Advantageously, these functions are introduced not as part of the SSCOP or other existing protocols expanded in accordance with the first stage, but in a separate protocol layer which can be called a convergence or multiplexing layer, although a direct introduction into the existing protocols already modified is also possible. Depending on application, an existing convergence layer can be expanded for this purpose (e.g. the SSCF for the NNI, described in Q.2140) or a new convergence layer can be introduced. With respect to the data transmitted via the transmission link, two

identification codes are necessary for this. One is an identification of the data stream and the other one a consecutive numbering of the messages within a data stream. If necessary, control messages for controlling (e.g. initializing) the individual data streams must also be defined.

In the identification of the message stream, an advantage of the arrangement of the function is found in a separate protocol layer. As a result, it may be possible to use message stream identifications already contained in the data of the users which renders unnecessary the introduction of a separate protocol field for this purpose and thus saves transmission capacity. Also as a result, it is not necessary to change the interface between the transmission protocol and its (existing) user. For example, this is possible in MTP Level 3 (Q.2210, Q.704) which - depending on ITU-T or ANSI as dict. - identifies between 16 and 256 explicit protocol streams via the so-called signaling link selection field (SLS). Furthermore, if necessary, additional preexisting information from the messages (e.g. origin and/or destination addresses or parts thereof) can be used in this special case in order to achieve a finer subdivision of the messages into individual, mutually independent streams. The layer Q.2140 between Q.2210 (broadband MTP Level 3) and Q.2110 (SSCOP) could thus be correspondingly modified without this having any influence on Q.2210.

As an alternative, the message streams can also be explicitly identified by a new protocol field which has the advantage that this can be done independently of the application, that is to say the convergence or multiplexing layer no longer needs to be informed about the fields of the user protocols. However, the interface to existing users must then be expanded

since, at least on handover and possibly on receipt of data, the stream to which the data belong must be explicitly identified. In addition,

additional data must normally be transmitted because existing protocols rarely have sufficiently large unused fields although this is not impossible.

For the consecutive numbering of the messages within a data stream, too, a new field will normally have to be introduced in the messages because existing protocols rarely have sufficiently large unused fields, although this is not impossible.

Control messages or fields for controlling the message streams are needed, in particular, when number and existence of the streams are not fixed but must be dynamically agreed between the two end points of the transmission link. If, however, permanently defined message streams are used as a basis, special control of the message streams is not absolutely necessary. However, it may be of advantage since, as a result, the protocol can be made more rugged and protocol errors which may have occurred in a message stream can have no influence on other streams. If no special control is carried out, the streams are automatically initialized on connection set-up of the basic protocol (e.g. SSCOP).

The following possible control functions can be considered, for example:

- opening and ending a stream
- resetting the sequence numbers of a stream
- stream-related flow control

Functionally, the convergence layer (or the function additionally built into the protocol) has to fulfill the following tasks:

- administering a receive buffer for each (active) stream.

- administering a transmit and a receive sequence number.

- Receiving the messages for a stream and checking the sequence number.
- If there are no gaps in the sequence number, delivery of the message - and possibly other messages waiting for this message in the receive buffer - to the user.
- If there are gaps in the sequence number, temporarily storing the message in the receive buffer.
- On transmission of the message, allocation of the transmit sequence number and possibly of the stream identification.
- If necessary, performing the control functions.

Furthermore, it may be of advantage that delivery in the correct order is dispensed with for one (or more) of the streams (which is used, for example, for messages of SCCP Class 0).

It should also be noted that the present invention is not restricted to MSR methods. It can also be applied to normal selective reject methods and also to go-back-N methods. In these cases, however, more adaptations, e.g. introduction of a receive buffer or a status bar for tracking the messages already delivered, are required in the receiving device than in the MSR methods.

<u>Re 4.</u>

In an exemplary embodiment, SSCOP (Q.2110) is modified to the extent that a free bit is used in SD-PDUs for identifying messages which do not need to be delivered in sequence (see Figure 1). Furthermore, Q.2140 is modified to the extent that 17 streams are introduced, one for SCCP Class 0 messages and 16 for the 16 possible SLS values of other messages (see Figures 4, 5 and 6). To avoid any change in the users,

the maximum allowable message length for the SSCOP (parameter k) is simultaneously increased to 4100 octets, since the modified SSCF needs an additional 4 octets of space (for fields SQ#,St# and status) per message (SD PDU with MTP 3b data) (see Figure 3).

Re 5.

The attached drawing with Figures 1 to 6 supports the representation of the invention described above.

Patent claims

1. A method for transmitting messages between a transmitting device and a receiving device of a transmission link, according to which
   - messages are consecutively numbered on transmission and
   - messages are requested again by the receiving device if it finds gaps in the received message stream with the aid of the consecutive numbering,

   characterized in that
   - immediately after reception, all messages or only messages having special features, are delivered to a higher device - service user - than the receiving device independently of whether messages need to be repeated by the transmitting device due to a gap found by the receiving device.

2. The method as claimed in claim 1, characterized in that messages which are immediately delivered are delivered to a multiplex device by the receiving device, the multiplex device allocating received messages to different message streams by means of said special features and continuing to treat messages of a message stream independently of messages of another stream.

3. The method as claimed in claim 1 or 2, characterized in that a special feature is a marking, added in the messages by the transmitting device, and/or a particular content of the messages.

4. The method as claimed in one of claims 2 to 3, characterized in that said multiplex device is a device of the transmission link itself or a device of a higher protocol layer than the transmission link.

5. A receiving device of a transmission link which receives consecutively numbered messages and requests messages again if it finds gaps in the received message stream with the aid of the consecutive numbering, characterized in that, immediately after reception, it delivers all messages or only messages having special features to a higher device - service user - than the receiving device independently of whether messages need to be repeated by the transmitting device due to a gap found.

6. Device of a transmission link, consisting of a receiving device, which receives consecutively numbered messages and requests messages again if it finds gaps in the received message stream with the aid of the consecutive numbering and, immediately after the reception, delivers all messages or only messages having special features to a higher-level multiplex device independently of whether messages need to be repeated by the transmitting device due to a gap having been found and of a multiplex device which allocates received messages to different message streams by means of special features of the messages and continues to treat messages of a message stream independently of messages of another stream.

7. The device according to claim 6, characterized in that said multiplex device is a device of the transmission link itself or a device of a higher protocol layer than the transmission link.

8. A method as claimed in one of claims 1 to 4, characterized in that the method is carried out in a protocol according to Q.2210 or a protocol derived therefrom, in such a manner that in the sequenced-data protocol data units - SD PDUs - a previously unused bit (I) is used for identifying messages which are to be immediately delivered to the receiver.

99 P 2040 Foreign version

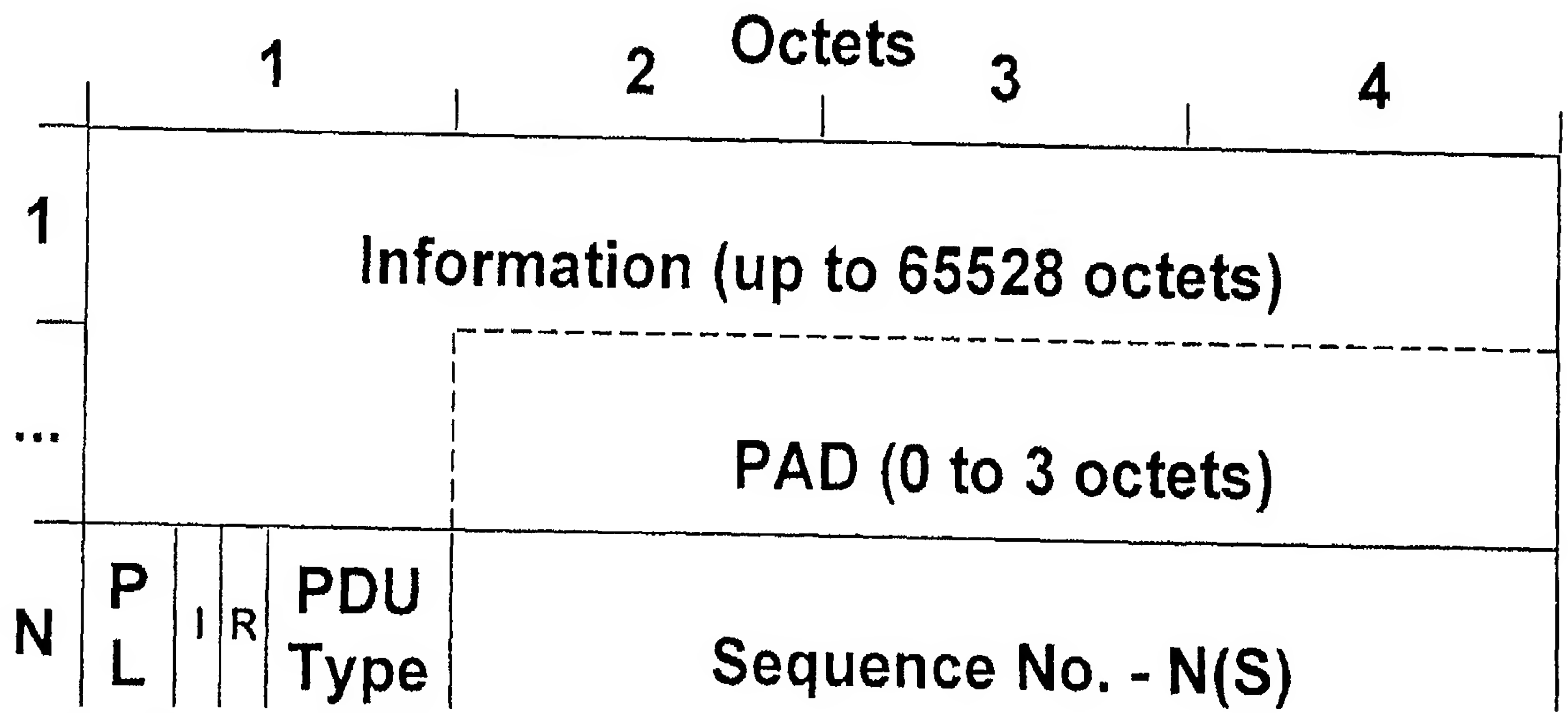
Abstract

Method for transmitting messages between a transmitting device and a receiving device of a transmission link

Frequently, a number of mutually independent message streams (e.g. messages for different receivers) are transmitted via a transmission link which exhibits a transmission protocol with error protected message transmission. However, since the transmission protocol is frequently unable to distinguish between the message streams, it may happen that the delivery of the messages of a message stream is delayed because a preceding message of another message stream has been lost and must be repeated. This problem is solved by the invention.

Figure 1: Sequenced Data PDU with identification of “in-sequence delivery”

In addition, the AA DATA signals are equipped with an additional parameter I at the interface to the SSCOP user.
I = SD indicates that sequenced delivery has been requested (with AA Data. indication) or is requested (with AA Data. request), i.e. field I in the SD.PDU is or has been set to 0.
I = USD indicates that sequenced delivery has not been or is not requested.



PL PAD Length (2 bits)
I In-sequence delivery bit (I=1: no in-sequence delivery required)
R reserved (1 bit)

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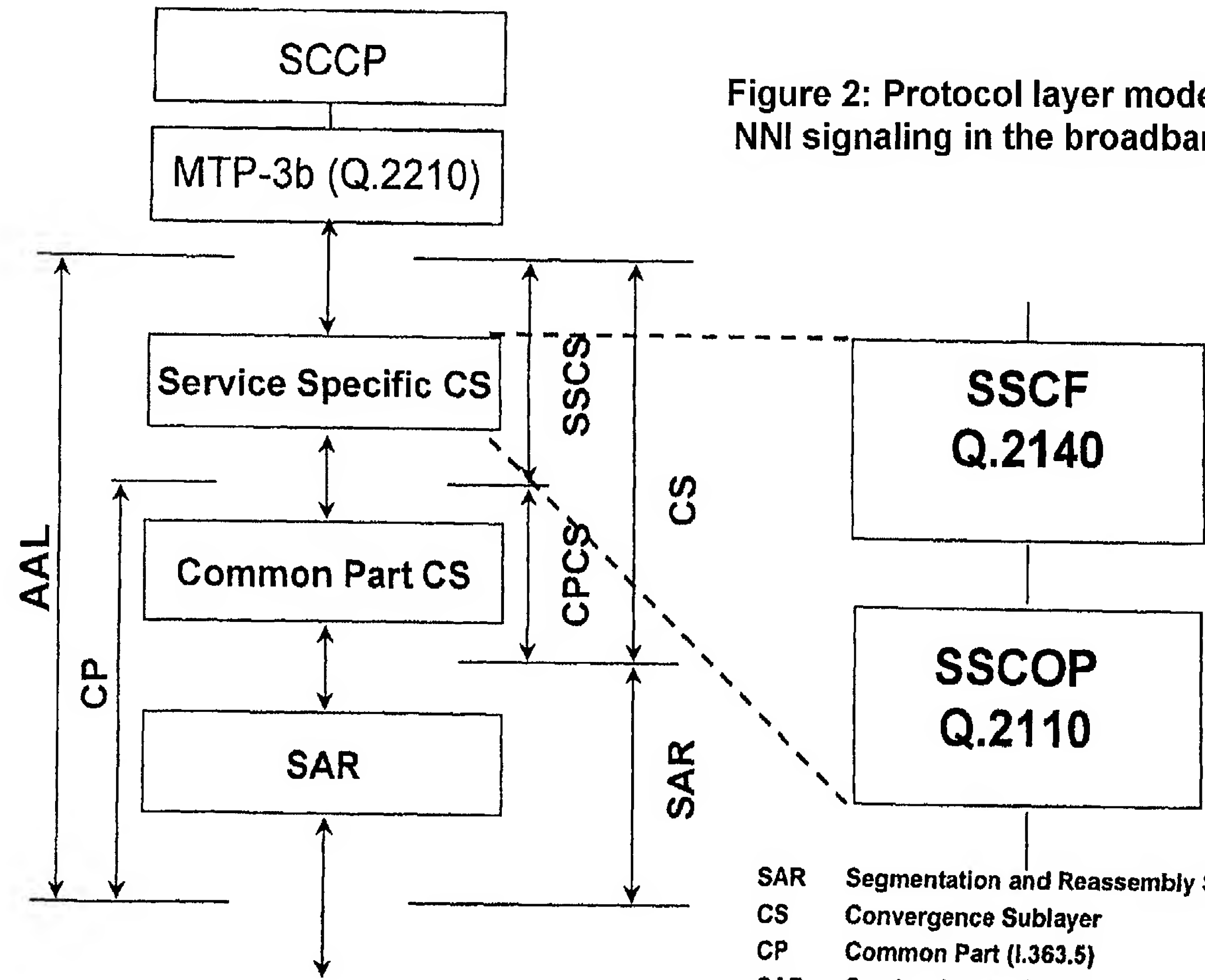


Figure 2: Protocol layer model for the NNI signaling in the broadband ISDN

SAR	Segmentation and Reassembly Sublayer
CS	Convergence Sublayer
CP	Common Part (I.363.5)
SAP	Service Access Point
AAL	ATM Adaptation Layer
SSCS	SSCOP+SSCF

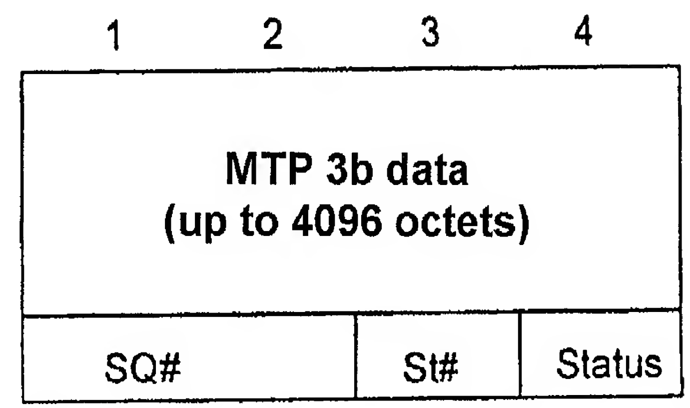


Figure 3: Message format of the modified SSCF

SQ#	Stream sequence number
St#	Stream number
Status	Status (St#=0) or control field (St#≠0)

The functions of the status field are described in Q.2140.
As a control field (only with stream number ≠ 0), the field has the following meaning

Bit 1 In-sequence delivery bit
0 in-sequence delivery required
1 in-sequence delivery not required

Bits 2 to 8 Reserved

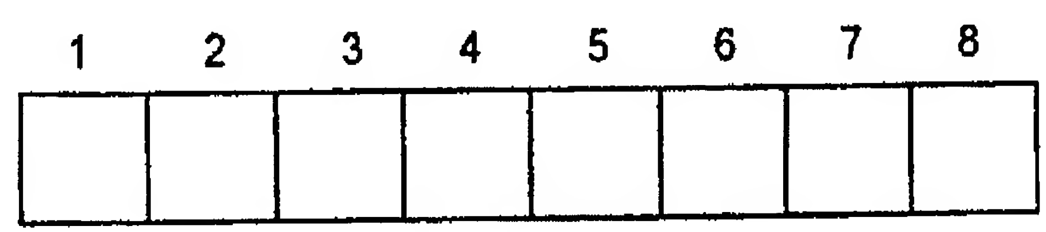


Figure 4: Additional SSCF functions when sending SSCF PDUs/MTP 3b data with an existing SSCOP connection (states 3/10/5, 2/10/3, 2/10/4) as SSCOP SD PDUs (stream 0 for unsequenced delivery, streams 1 to 16 for sequenced delivery)

New transmitter variables

VT(S.n), 1<=n<=16 Transmit sequence counter per stream, initialized with zero on SSCOP connection setup or reset

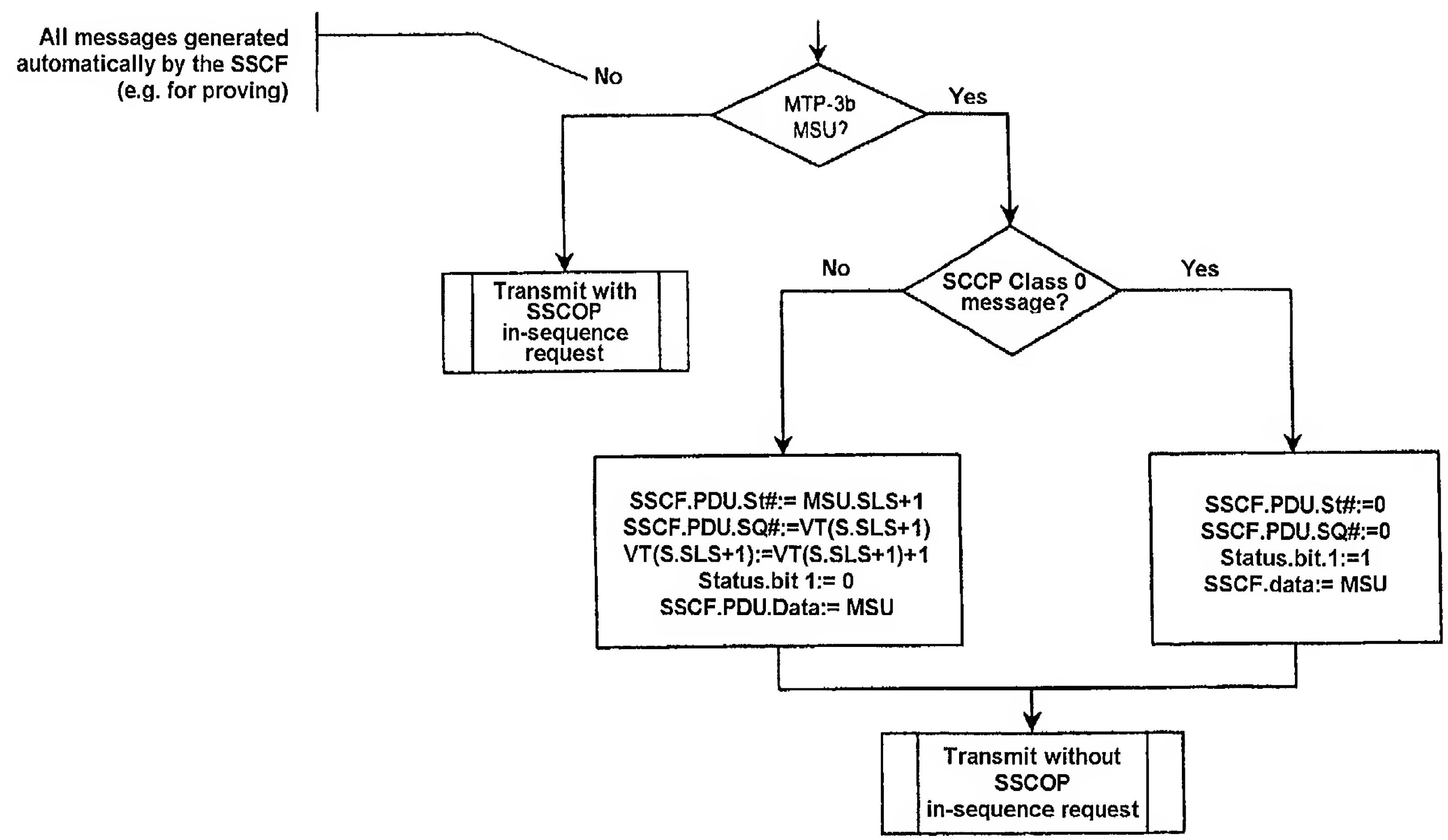


Figure 5: **Additional SSCF functions when receiving SSCF PDUs/MTP 3b data with an existing SSCOP connection (states 3/10/5, 2/10/3, 2/10/4) as SSCOP SD PDUs (stream 0 for unsequenced delivery, streams 1 to 16 for sequenced delivery)**

New receiver variables

VR(S.n), 1<=n<=16 Received sequence counter per stream,
initialized with zero on SSCOP connection setup or reset

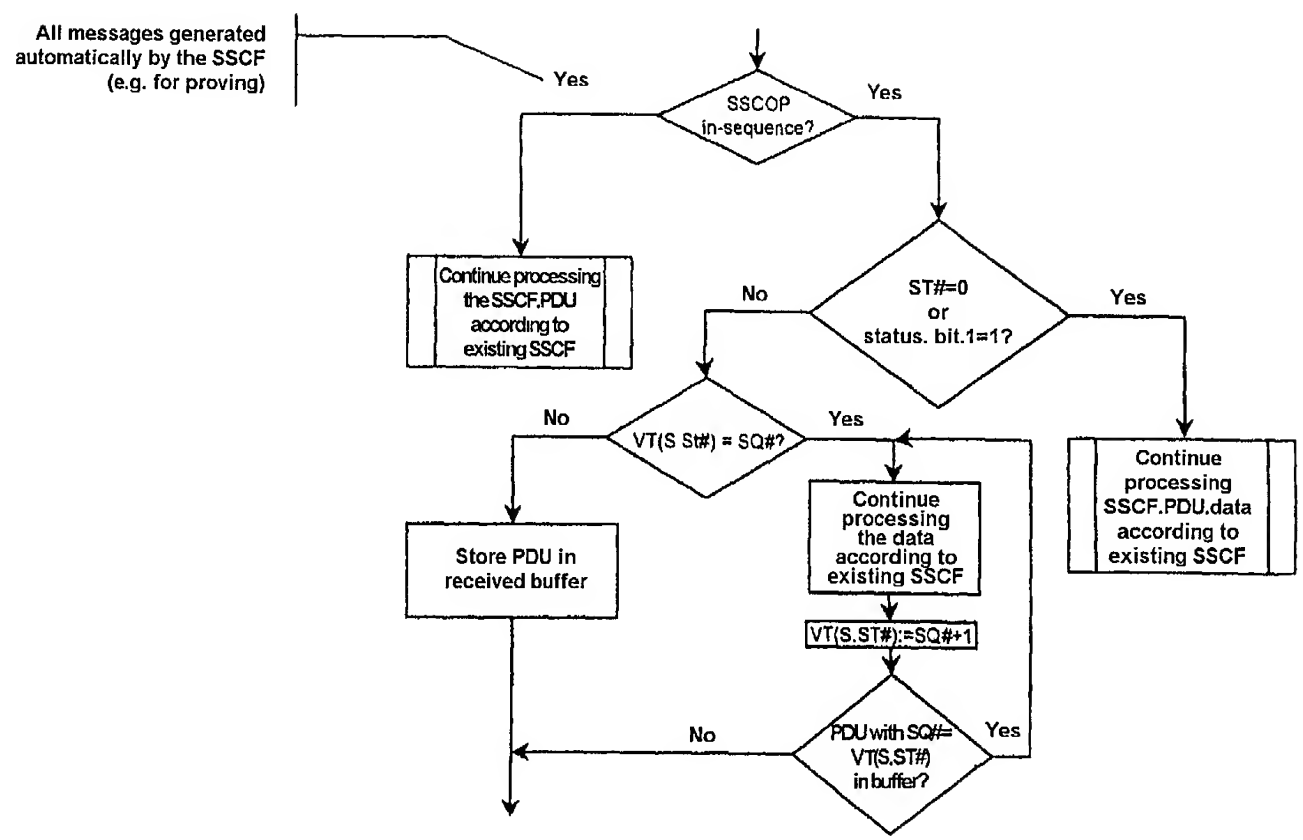
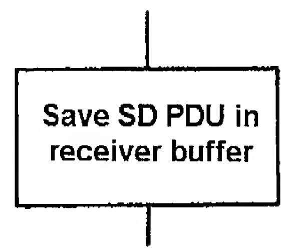
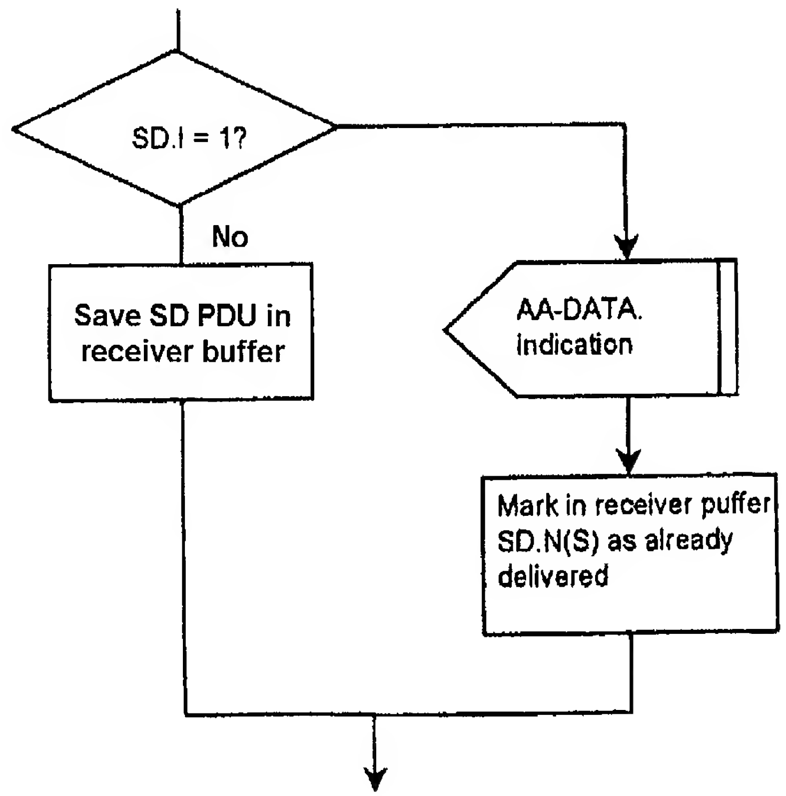


Figure 6: Modifications to the SSCOP process, figure in Q.2110

1. All events of the instruction



are replaced by



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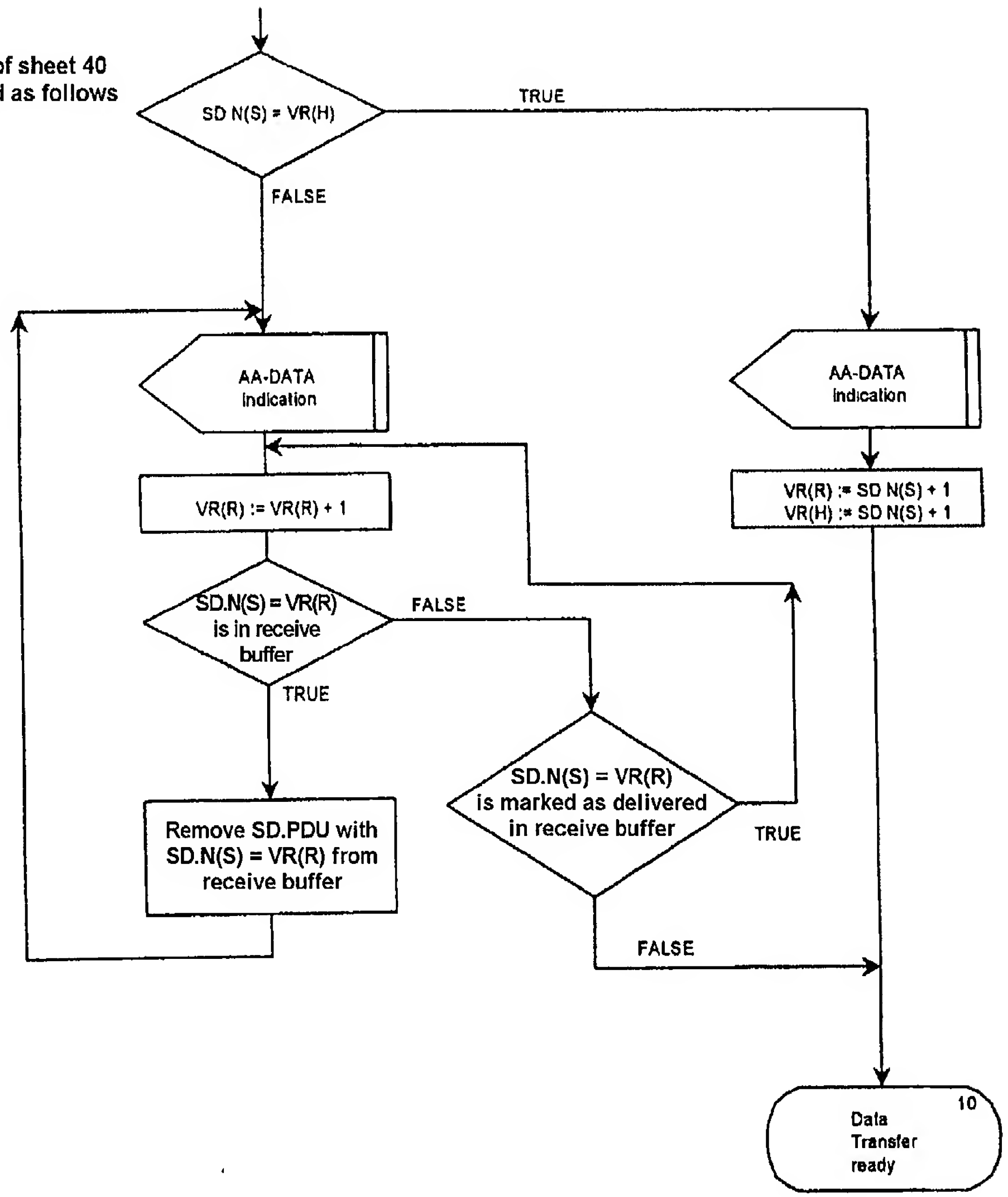
2. The bottom right-hand part of sheet 40 of figure 20/Q.2110 has changed as follows



Declaration and Power of Attorney For Patent Application

Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

Methode, Vorrichtung und Anordnung zur Verbesserung der Nachrichtenübertragung

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

deren Beschreibung

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am ____________ als PCT internationale Anmeldung
PCT Anmeldungsnummer ____________
Eingereicht wurde und am ____________ abgeändert wurde (falls tatsächlich abgeändert).

the specification of which

(check one)

☐ is attached hereto.

☐ was filed on ____________ as PCT international application
PCT Application No. ____________
and was amended on ____________ (if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications
Priorität beansprucht

Priority Claimed

199 27 289.1	Germany	15. Juni 1999	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

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German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

19

And I hereby appoint

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3-00

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Unterschrift des Erfinders — Datum	Inventor's signature — Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).